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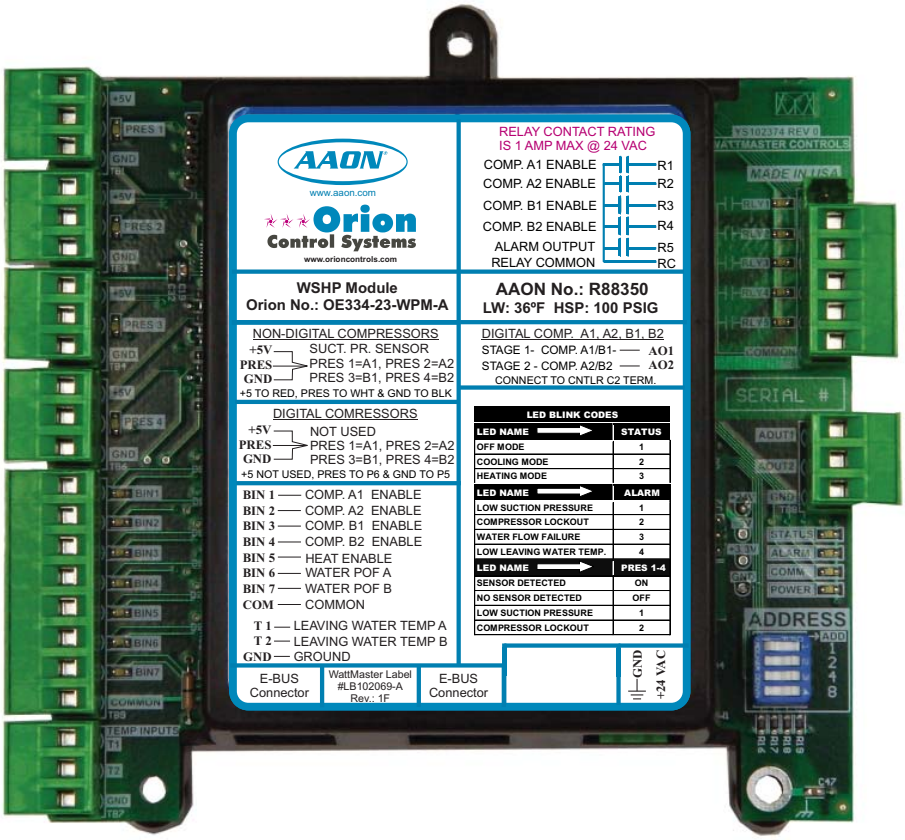
Factory Packaged Controls

Water Source Heat Pump Module Technical Guide



PART NUMBER CROSS REFERENCE TABLE		
PART DESCRIPTION	ORION	AAON
VCM-X WSHP Module R410	OE334-23-WPM-A	R88350
VCM-X WSHP Module R410 - 20% Glycol	OE334-23-WPM-A20	R99750
VCM-X WSHP Module R410 - 25% Glycol	OE334-23-WPM-A25	R88351
VCM-X WSHP Module R410 - 40% Glycol	OE334-23-WPM-A40	R99760
VCM-X WSHP Module R22	OE334-23-WPM-22-A	R90680
VCM-X WSHP E-BUS Controller	OE332-23E-VCMX-WSHP-A	V07140
VCM-X WSHP Controller	OE332-23-VCMX-WSHP-A	R90810
SA E-BUS Controller	OE332-23E-SA-A	V07160
SA Controller	OE332-23-SA-A	R96070
SA Expansion Module	OE333-23-SA-A	R96180
E-BUS Distribution Module	OE365-23-EBD	R82930

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Module Overview

Overview

The Water Source Heat Pump Module monitors the compressors on an AAON Water Source Heat Pump unit and can disable the compressors based on low Suction Pressure, Leaving Water Temperature, and Water Proof of Flow inputs. It also utilizes a Delay Timer to prevent the compressors from turning on at the same time.

There are two water-only versions of the Water Source Heat Pump Module—the OE334-23-WPM-A which uses R-410A refrigerant and the OE334-23-WPM-22-A which uses R-22 refrigerant.

There are also three R-410-A glycol versions—the OE334-23-WPM-A20 which uses 20% glycol—the OE334-23-WPM-A25 which uses 25% glycol and the OE334-23-WPM-A40 which uses 40% glycol.

The Water Source Heat Pump Module can be used stand-alone. It can also be connected to the VCM-X WSHP Controller (OE332-23-VCMX-WSHP-A) or SA Controller (OE332-23-SA) using the E-BUS Distribution Module (OE365-23-EBD). This allows the Water Source Heat Pump Module to receive control data and alarms from the VCM-X WSHP or SA Controller. **Please note:** The SA Controller only works with the OE-334-WPM-A (410A version).

The Water Source Heat Pump Module requires a 24 VAC power connection with an appropriate VA rating.

Features

The Water Source Heat Pump Module provides the following:

- Can be operated stand-alone or connected to a VCM-X WSHP Controller or SA Controller using the E-BUS Distribution Module to E-BUS interface
- Capable of controlling digital compressors when connected to the VCM-X WSHP Controller or SA Controller
- Monitors suction pressure, leaving water temperature, and water proof of flow
- Provides Delay Timer to prevent compressors from turning on at the same time

NOTE: The Water Source Heat Pump Module contains no user-serviceable parts. Contact qualified technical personnel if your Module is not operating correctly.

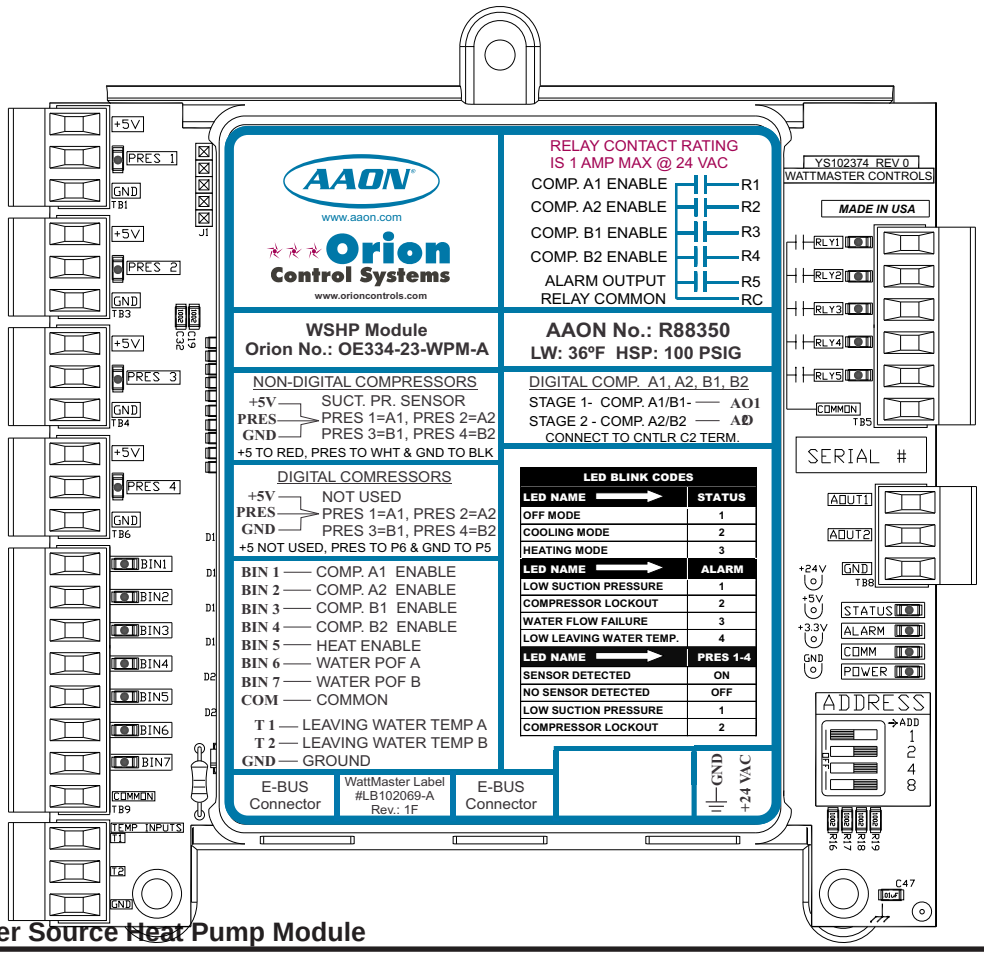


Figure 1: Water Source Heat Pump Module

Environmental Requirements

The Water Source Heat Pump Module needs to be installed in an environment that can maintain a temperature range between -30°F and 150°F and not exceed 90% RH levels (non-condensing).

Mounting

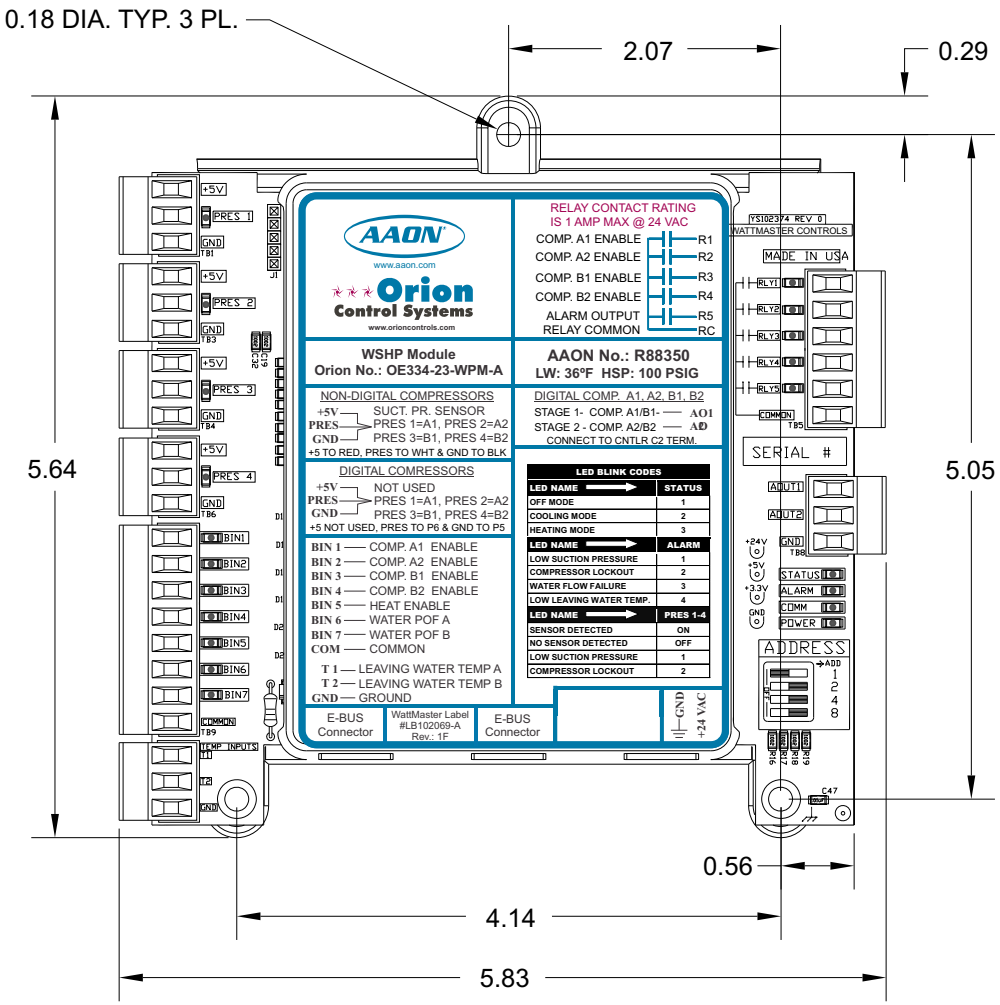
The Water Source Heat Pump Module is housed in a plastic enclosure. It is designed to be mounted by using the 3 mounting holes in the enclosure base. It is important to mount the module in a location that is free from extreme high or low temperatures, moisture, dust, and dirt. Be careful not to damage the electronic components when mounting the module. **See Figure 2** for Module dimensions (dimensions are in inches).

Power Supply

The Water Source Heat Pump Module requires a 24 VAC power connection with an appropriate VA rating.

If you will be connecting the Water Source Heat Pump Module to the VCM-X WSHP Controller or SA Controller, one of the most important checks to make before powering up the system for the first time is to make sure that the VCM-X WSHP Controller or SA Controller is configured properly for your application. Refer to the *VCM-X Controller Technical Guide* or *SA Controller Technical Guide* for more information.

WARNING:	Observe polarity! All boards must be wired GND-to-GND and 24 VAC-to-VAC. Failure to observe polarity could result in damage to the boards.



Note: Height is 1.49 inches.

Figure 2: Water Source Heat Pump Module Dimensions

Important Wiring Considerations

Please read carefully and apply the following information when wiring the Water Source Heat Pump Module:

1. To operate the Water Source Heat Pump Module in Stand-Alone mode, you must connect power to the 24 VAC input terminal block. Do not allow wire strands to stick out and touch adjoining terminals. This could potentially cause a short circuit.
2. The 1 to 5 VDC signals for the Compressor modulation need to use 18-gauge shielded twisted pair cable, and the Drain wire must be the GND signal.
3. All 24 VAC wiring must be connected so that all ground wires remain common. Failure to follow this procedure can result in damage to the module and connected devices.
4. Be sure all modular wiring harness connectors are seated firmly in their respective modular connectors on the circuit board.
5. All wiring is to be in accordance with local and national electrical codes and specifications.
6. Check all wiring leads at the terminal block for tightness. Be sure that wire strands do not stick out and touch adjacent terminals. Confirm that all transducers required for your system are mounted in the appropriate location and wired into the correct terminals.

Stand-Alone Wiring

To operate the Water Source Heat Pump Module as Stand Alone, connect the Module to a 24 VAC power connection with an appropriate VA rating. See **Figure 3** for wiring.

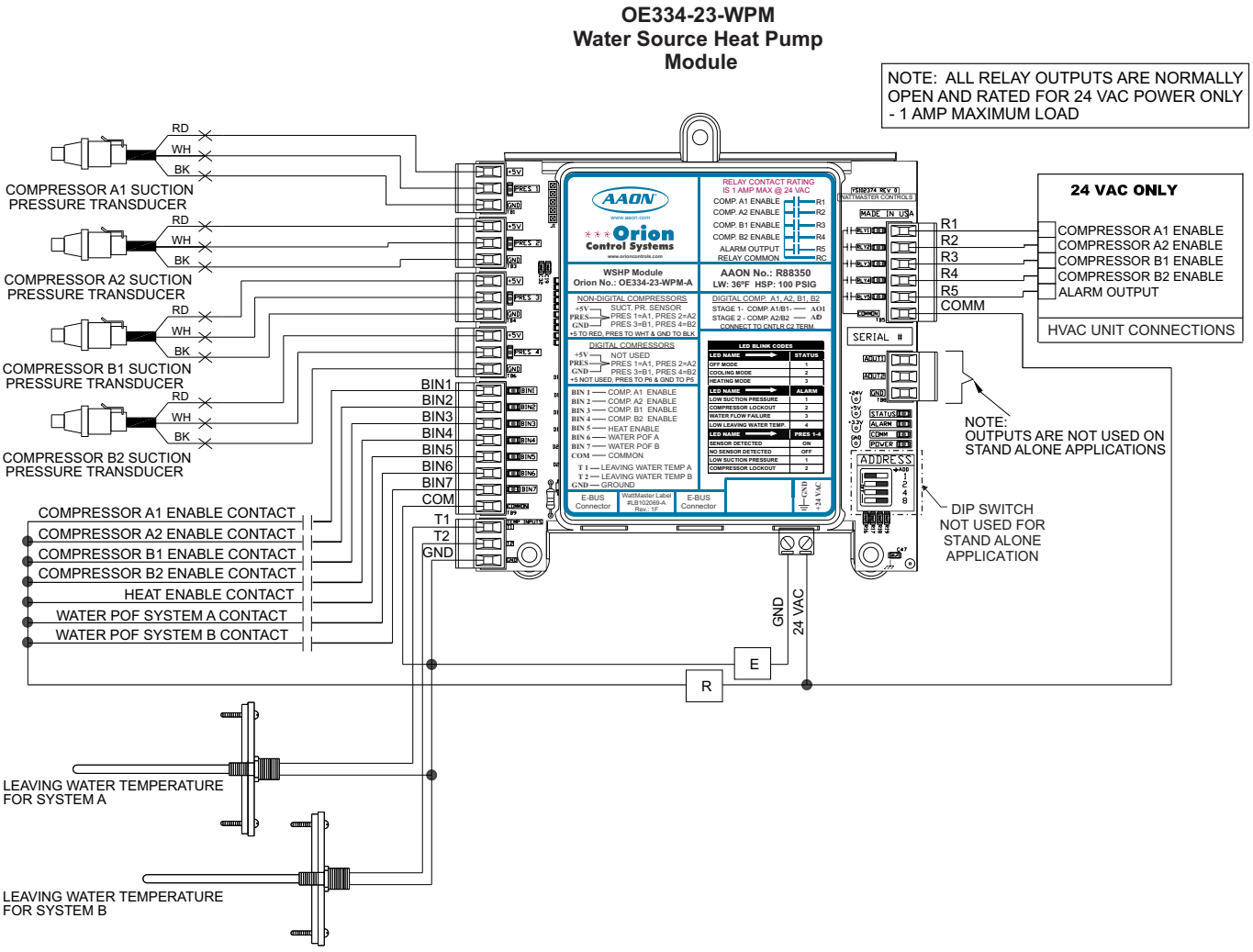


Figure 3: Water Source Heat Pump Module as Stand-Alone

E-BUS to Water Source Heat Pump Module Wiring

The Water Source Heat Pump Module connects to the E-BUS Distribution Module using a modular HSSC cable. The Water Source Heat Pump Module requires a 24 VAC power connection with an appropriate VA rating.

The E-BUS Distribution Module connects to the VCM-X WSHP Controller, VCM-X Expansion Module, SA Controller, SA Expansion Module, or 12 Relay Expansion Module using the I^2C port. See **Figure 4** for wiring.

Any E-BUS Module can be connected to each of the four E-BUS Distribution Module's output ports or can be daisy-chained together using HSSC cables.

If using a spliced terminal connection for longer runs, one module can be connected to the E-BUS Distribution Module and any additional modules would be daisy-chained to the first module. For more information, refer to the *E-BUS Distribution Module Technical Guide.*

NOTE: Contact Factory for the correct HSSC cable length for your application. Cables are available in 1/4, 1/2, 1, 2, 3, 4, and 5 Meter lengths and 100 and 150 Foot lengths.

WARNING: Be sure all controllers and modules are powered down before connecting or disconnecting HSSC cables.

Addressing

When the WSHP Module is connected to the E-BUS Distribution Module, set the WSHP Module's address to 1. Set the address consecutively for each WSHP Module you are using.

NOTE: Address zero defaults to address 1.

VCM-X WSHP or SA Controller to Water Source Heat Pump Module Wiring

The VCM-X WSHP Controller or SA Controller communicates with the Water Source Heat Pump Module using the E-BUS Distribution Module. See **Figure 4** for wiring details (VCM-X WSHP Controller shown).

NOTE: When using the WSHP Module, all compressors will be wired from the WSHP Module, not the VCM-X WSHP Controller or SA Controller.

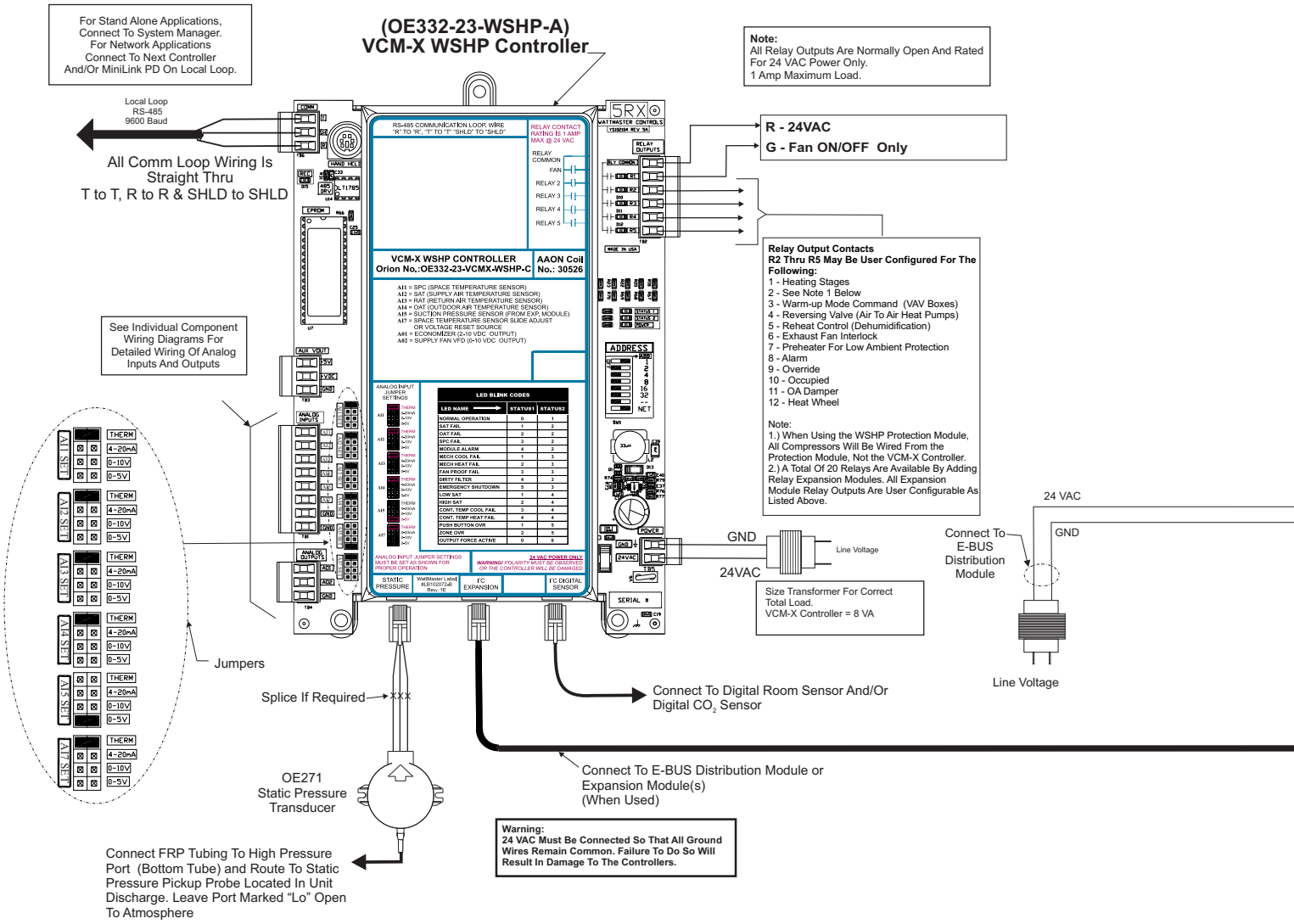

For Stand Alone Applications, Connect To System Manager. For Network Applications Connect To Next Controller And/Or MiniLink PD On Local Loop.
(OE332-23-WSHP-A)
VCM-X WSHP Controller
Note:
All Relay Outputs Are Normally Open And Rated For 24 VAC Power Only.
1 Amp Maximum Load.
Local Loop
RS-485
9600 Baud
All Comm Loop Wiring Is Straight Thru
T to T, R to R & SHLD to SHLD
R - 24VAC
G - Fan ON/OFF Only
Relay Output Contacts
R2 Thru R5 May Be User Configured For The Following:
1 - Heating Stages
2 - See Note 1 Below
3 - Warm-up Mode Command (VAV Boxes)
4 - Reversing Valve (Air To Air Heat Pumps)
5 - Reheat Control (Dehumidification)
6 - Exhaust Fan Interlock
7 - Preheater For Low Ambient Protection
8 - Alarm
9 - Override
10 - Occupied
11 - OA Damper
12 - Heat Wheel
Note:
1.) When Using the WSHP Protection Module, All Compressors Will Be Wired From the Protection Module, Not the VCM-X Controller.
2.) A Total Of 20 Relays Are Available By Adding Relay Expansion Modules. All Expansion Module Relay Outputs Are User Configurable As Listed Above.
See Individual Component Wiring Diagrams For Detailed Wiring Of Analog Inputs And Outputs
VCM-X WSHP CONTROLLER
Orion No.:OE332-23-VCMX-WSHP-C
AAON Coil No.: 30526
LED BLINK CODES
GND
24VAC
Line Voltage
Size Transformer For Correct Total Load.
VCM-X Controller = 8 VA
24 VAC
GND
Connect To E-BUS Distribution Module
Line Voltage
Jumpers
Splice If Required
Connect To Digital Room Sensor And/Or Digital CO2 Sensor
Connect To E-BUS Distribution Module or Expansion Module(s) (When Used)
OE271
Static Pressure
Transducer
Connect FRP Tubing To High Pressure Port (Bottom Tube) and Route To Static Pressure Pickup Probe Located In Unit Discharge. Leave Port Marked "Lo" Open To Atmosphere
Warning:
24 VAC Must Be Connected So That All Ground Wires Remain Common. Failure To Do So Will Result In Damage To The Controllers.

Figure 4: VCM-X WSHP Controller to Water Source Heat Pump Module Wiring Diagram

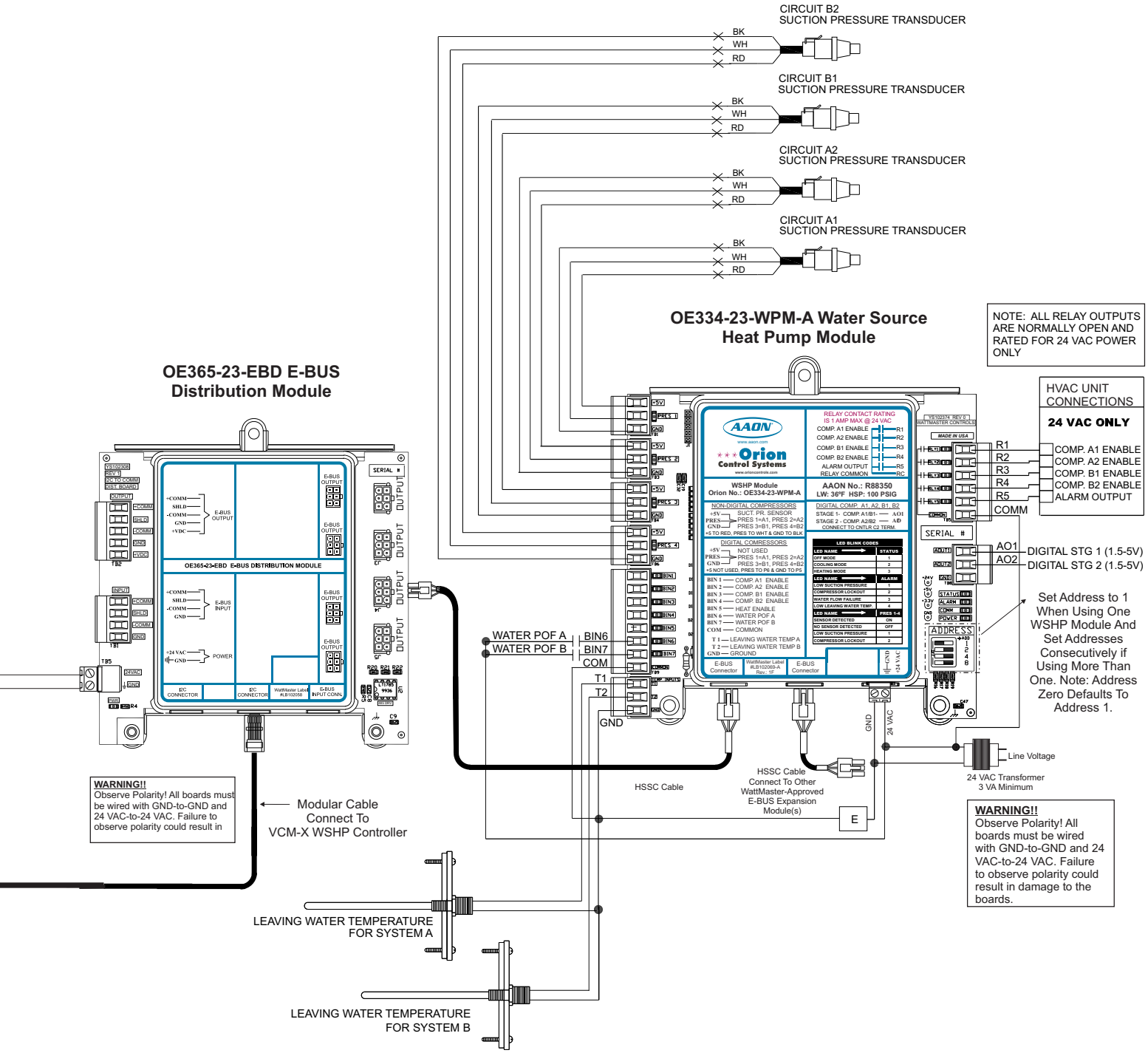

CIRCUIT B2
SUCTION PRESSURE TRANSDUCER
BK
WH
RD
CIRCUIT B1
SUCTION PRESSURE TRANSDUCER
CIRCUIT A2
SUCTION PRESSURE TRANSDUCER
CIRCUIT A1
SUCTION PRESSURE TRANSDUCER
OE334-23-WPM-A Water Source Heat Pump Module
NOTE: ALL RELAY OUTPUTS ARE NORMALLY OPEN AND RATED FOR 24 VAC POWER ONLY
OE365-23-EBD E-BUS Distribution Module
HVAC UNIT CONNECTIONS
24 VAC ONLY
R1 COMP. A1 ENABLE
R2 COMP. A2 ENABLE
R3 COMP. B1 ENABLE
R4 COMP. B2 ENABLE
R5 ALARM OUTPUT
COMM
AO1 DIGITAL STG 1 (1.5-5V)
AO2 DIGITAL STG 2 (1.5-5V)
Set Address to 1 When Using One WSHP Module And Set Addresses Consecutively if Using More Than One. Note: Address Zero Defaults To Address 1.
WATER POF A BIN6
WATER POF B BIN7
COM
T1
T2
GND
HSSC Cable
HSSC Cable Connect To Other WattMaster-Approved E-BUS Expansion Module(s)
Line Voltage
24 VAC Transformer 3 VA Minimum
WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC. Failure to observe polarity could result in damage to the boards.
Modular Cable Connect To VCM-X WSHP Controller
LEAVING WATER TEMPERATURE FOR SYSTEM A
LEAVING WATER TEMPERATURE FOR SYSTEM B

Figure 4, cont.: VCM-X WSHP Controller to Water Source Heat Pump Module Wiring Diagram

General

In order to have a trouble free start-up, it is important to follow a few simple procedures. Before applying power for the first time, it is very important to run through a few simple checks.

One of the most important checks to make before powering up the system for the first time is to make sure that the VCM-X WSHP Controller or SA Controller is configured properly for your application. Refer to the *VCM-X Controller Technical Guide* or *SA Controller Technical Guide* for more information.

A handheld Modular Service Tool, Modular System Manager, or System Manager Touch Screen connected to the VCM-X WSHP Controller or SA Controller will allow you to configure your application. Refer to the *VCM-X Operator's Interfaces Technical Guide, SA Operator Interfaces Technical Guide,* or *System Manager TS Technical Guide* for more information.

NOTE: The SA Controller does not utilize the System Manager Touch Screen.

Check all wiring leads at the terminal block for tightness. Be sure that wire strands do not stick out and touch adjacent terminals. Confirm that all sensors required for your system are mounted in the appropriate location and wired into the correct terminals.

WARNING: Observe polarity! All boards must be wired GND-to-GND and 24 VAC-to-VAC. Failure to observe polarity could result in damage to the boards.

UNIT CONFIGURATIONS						
PERMUTATION	SYSTEM A		SYSTEM B		VCM-X WSHP CONFIGURATION	SA CONFIGURATION
	Comp A1	Comp A2	Comp B1	Comp B2		
	Relay 1	Relay 2	Relay 3	Relay 4		
1	On/Off	On/Off			2 Compressors	
2	Digital	On/Off			2 Compressors Digital Compressor	2 Compressors Single Unit SA
3	Digital	Digital			2 Compressors Full Digital	2 Compressors Single Unit SA
4	On/Off	On/Off	On/Off	On/Off	4 Compressors	
5	Digital	On/Off	On/Off	On/Off	Not Available	
6	Digital	On/Off	Digital	On/Off	4 Compressors Digital Compressor	4 Compressors Dual Unit SA
7	Digital	Digital	Digital	Digital	4 Compressors Full Digital	4 Compressors Dual Unit SA

In the *Cooling Mode*, the Compressors will stage in the following order:

Permutations 1, 2 & 3: Compressor A1 -> Compressor A2
Permutations 4: Compressor A1 -> Compressor B1 -> Compressor A2 -> Compressor B2
Permutations 6: Compressor A1 & Compressor B1 -> Compressor A2 -> Compressor B2
Permutations 7: Compressor A1 & Compressor B1 -> Compressor A2 & Compressor B2

In the *Dehumidification Mode*, the Compressors will stage in the following order:

Permutation 4: Compressor A1 & Compressor B1 -> Compressor A2 -> Compressor B2

All other permutations in the Dehumidification Mode stage as described in the Cooling Mode.

Table 1: Unit Configurations Chart

General

The following inputs and outputs are available on the Water Source Heat Pump Module. See **Table 2** below to reference the Input/Output Map.

Binary Inputs	
1	Compressor A1 Enable (BIN 1)
2	Compressor A2 Enable (BIN 2)
3	Compressor B1 Enable (BIN 3)
4	Compressor B2 Enable (BIN 4)
5	Heat Enable (BIN 5)
6	Water Proof of Flow System A (BIN 6)
7	Water Proof of Flow System B (BIN 7)
Analog Inputs	
1	Suction Pressure A1 (Pres 1)
2	Suction Pressure A2 (Pres 2)
3	Suction Pressure B1 (Pres 3)
4	Suction Pressure B2 (Pres 4)
5	Leaving Water Temperature System A (T1)
6	Leaving Water Temperature System B (T2)
Analog Outputs (1-5 VDC)	
1	Digital Stage 1 (Compressors A1 & B1) (AOUT1)
2	Digital Stage 2 (Compressors A2 & B2) (AOUT2)
NOTE: Analog Outputs are not used on Stand Alone Application	
Relay Outputs (24 VAC)	
1	Compressor A1 Enable Output (RLY1)
2	Compressor A2 Enable Output (RLY2)
3	Compressor B1 Enable Output (RLY3)
4	Compressor B2 Enable Output (RLY4)
5	Alarm Output (RLY5)

Table 2: Water Source Heat Pump Module Inputs & Outputs

Water Source Heat Pump Module Setpoints

The Water Source Heat Pump Module setpoints are preset at AAON and are based on the unit's design as well as the type of coolant being used in the water loop. See **Tables 3 & 4** for default settings.

NOTE: These are default settings only. The setpoints may be different based on the unit's design and coolant being used. The 6-digit R numbers in the tables are the AAON part numbers located on the module's label.

Water-Only Default Setpoints		
Description	R410-A R88350	R22 R90680
UNSAFE SUCTION	**40 PSIG**	**20 PSIG**
LOW SUCTION HEAT MODE	**100 PSIG**	**57 PSIG**
LOW SUCTION COOL MODE	**100 PSIG**	**57 PSIG**
LOW LEAVING WATER TEMP	**37ºF**	**37ºF**

Table 3: Factory-Set Default Setpoints - Water Only

Glycol Default Setpoints			
Description	R410-A 20% Glycol R99750	R410-A 25% Glycol R88351	R410-A 40% Glycol R99760
UNSAFE SUCTION	**40 PSIG**	**40 PSIG**	**40 PSIG**
LOW SUCTION HEAT MODE	**77 PSIG**	**65 PSIG**	**45 PSIG**
LOW SUCTION COOL MODE	**85 PSIG**	**85 PSIG**	**85 PSIG**
LOW LEAVING WATER TEMP	**23ºF**	**19ºF**	**0ºF**

Table 4: Factory-Set Default Setpoints - Glycol

Stand-Alone Input Commands

Compressor On/Off

A 24 volt signal to Binary Inputs #1-4 initiates each Compressor's On function. The source for this signal would typically come from Y1 to Y4 calls from the thermostat.

Heat Enable On/Off

A 24 volt signal on this input indicates the unit is in the Heating Mode. Typically, the source for this signal is the "O" call from the thermostat.

Water Proof of Flow System On/Off

A 24 volt signal to Binary Inputs #6-7 indicates Water Proof of Flow for each system.

Suction Pressure Analog Inputs

Sensors from Analog Inputs #1-4 correlate with the Suction Pressure of each Compressor (250 PSI).

Leaving Water Temperature Thermistor Inputs

T1 correlates with Compressors A1 & A2 (RLY1 and RLY2). T2 correlates with Compressors B1 & B2 (RLY3 and RLY4).

Input Commands (VCM-X WSHP or SA Connection)

NOTE: When the term "ON" is used, it means there is either 24 VAC on the appropriate Binary Input or a call-to-run signal is being received from the VCM-X WSHP or SA Controller. When the term "OFF" is used, it means there is either 0 VAC on the appropriate Binary Input or the call-to-run signal from the VCM-X WSHP or SA has been removed.

Compressor On/Off

Instead of a physical input signaling the Compressor On/Off function, the VCM-X WSHP Controller or SA Controller communications drives the Compressor On/Off function.

Heat Enable On/Off

As with the Compressor On/Off function, the VCM-X WSHP or SA Controller communicates to the Module that it is in Heat Mode.

Modes of Operation

NOTE: See Unit Configurations Chart on page 10 for more information about compressor staging.

Digital Stage 1 / Digital Stage 2

On units with two Digital Scroll Compressors, the first compressor (A1) will be designated as Digital Stage 1 and the second compressor (A2) will be designated as Digital Stage 2.

On units with four Digital Scroll Compressors, there may be instances where compressor numbers on the module do not correlate with the mechanical compressors' numbers. Therefore, Digital Stage 1 refers to the first set of Digital Scroll Compressors (A1/B1) that will stage on together and Digital Stage 2 refers to the second set of Digital Scroll Compressors (A2/B2) that will stage on together. Please refer to AAON's wiring diagram for specific wiring of the unit.

Compressor Operation (Heat/Cool)

A compressor can energize if the following is true:

1. There is 24 VAC applied to the appropriate Binary Input for the Compressor.
2. If two compressors are enabled simultaneously, a 5 second staging delay will occur.
3. Suction Pressure is above the Low Suction Pressure Cooling (Heating) Setpoint.
4. Proof of Flow for the appropriate water loop is made.
5. Leaving Water Temp is above the Leaving Water Safety Setpoint (Heating Only).
6. A minimum off time of 3 minutes is met for that compressor.

NOTE: If the WSHP Module receives a signal on the Heat Enable input, it will operate using the Heating Mode Setpoints.

Cooling Mode

NOTE: Control of digital compressor(s) is only available when the WSHP Module is connected to the VCM-X WSHP Controller or SA Controller.

Fixed Compressors Only

When a Cool Signal is received, the WSHP Module will go into Cooling Mode. If this unit has only fixed compressors, they will sequentially stage according to Table 1 on page 10, using Stage Up and Stage Down delays to maintain the Supply Air Setpoint that is broadcast from the VCM-X WSHP Controller or SA Controller.

Digital Scroll Compressor Control

When a Cool Signal is received, the WSHP Module will go into Cooling Mode. At this point, Compressor A1 (and B1*) will energize and Digital Stage 1 Analog Output will modulate as necessary to maintain the Supply Air Temperature at the Active Supply Air Setpoint that is broadcast from the VCM-X WSHP Controller or SA Controller.

When Digital Stage 1 reaches 60%, a stage up timer is started and Digital Stage 1 will continue to modulate up as necessary. If Digital Stage 1 stays above 60% for the stage up timer, Compressor A2 (and B2*) will energize and both Digital Stage 1 and Digital Stage 2 outputs will go to ½ of the current position of Digital Stage 1. For example, if Digital Stage 1 is at 80% when Digital Stage 2 energizes, both systems will go to 40% and start modulating together.

If both systems are energized and they go below 30% and the Supply Air is below the Supply Air Setpoint by the Cooling Stage Window value, the stage down timer is started. If the systems remain below 30% for the duration of the stage down timer, Digital Stage 2 will deactivate and Digital Stage 1 will go to 60%. Digital Stage 1 will stage down if it is at 0% for the duration of the stage down timer.

* If configured for 4 modulating compressors.

Heat Pump Heating Mode

Heating Mode works the same as Cooling Mode except the Reversing Valve is switched and the sequence is opposite. Compressors modulate up when below the Heating Supply Air Setpoint and modulate down when above the setpoint.

Dehumidification Mode

Fixed Compressors Only

In the Dehumidification Mode, if this unit has only fixed compressors, they will sequentially stage according to Table 1 on page 10 to maintain the Suction Pressure Setpoint. Compressors A1 & B1 will stage on together first followed sequentially by A2 & then B2. Stage Up and Stage Down delays will apply.

Digital Scroll Compressor Control

In Dehumidification Mode, compressors will be controlled to maintain the Suction Pressure Temperature Setpoint. Digital Stage 1—Compressor A1 (and B1*) will modulate up to 100% before Digital Stage 2—Compressor A2 (and B2*) can be energized. When Digital Stage 2 is energized, Digital Stage 1 will be locked at 100%.

* If configured for 4 modulating compressors.

Staging Delays

Staging Delays minimum run times and minimum off times are sent from the VCM-X WSHP Controller or SA Controller.

Safety Monitoring

Proof of Flow

There are separate inputs for System A and System B. System A provides water for Compressors A1 & A2 and System B provides water for Compressors B1 & B2.

1. If there is a call for a compressor and there is no Proof of Flow Input Enable:
    - The module will wait up to 3 minutes to activate the Proof of Flow Alarm LED(s) which will blink the code indicating failure.
    - Proof of Water Flow A will disable compressors A1 and A2.
    - Proof of Water Flow B will disable compressors B1 and B2.
2. If the compressor(s) is (are) running and contact is opened for 2 seconds during Heat Pump Heating:
    - Compressor(s) will be turned off.
    - Proof of Water Flow A will disable compressors A1 and A2.
    - Proof of Water Flow B will disable compressors B1 and B2.
3. If the compressor(s) are running and contact is opened for 2 seconds during Cooling:
    - Proof of Flow Input will be ignored.
    - No alarm will be generated.

Low Suction Pressure Detection

1. If any Compressor's Suction Pressure falls below the Low Suction Pressure Setpoint for longer than 1 minute, then the following will occur:
    - The compressor will turn off.
    - Alarm LED will indicate Low Suction Pressure.
    - Compressor will be enabled again after 10 minutes if Suction Pressure rises above setpoint.
2. If any Compressor's Suction Pressure falls below the Low Suction Pressure Setpoint for longer than 1 minute a second time within a two hour window, then the following will occur:
    - That compressor will be locked out.
    - Alarm LED will indicate a Compressor Lockout.
    - Manual reset or change of mode (i.e., Cool to Heat) must occur to reset back to normal operation.

Unsafe Suction Pressure Detection

If the Suction Pressure falls below the Unsafe Suction Setpoint for 5 seconds, the compressor will be locked out immediately and will not be allowed to restart. You will need to reset the Power to restart the unit.

Low Leaving Water Temperature

NOTE: This safety monitoring is only performed in the Heat Mode.

On the larger units, there are two separate condenser/water sections and each section (water system) has its own Leaving Water Temperature Sensor. Each sensor will only affect the compressors associated with that condenser/water section. The description below describes System A. System B works the same but will affect Compressors B1 & B2.

1. If the Leaving Water Temperature for System A falls below setpoint, the following will occur:
    - Compressor A2 will deactivate if active.
    - Alarm LED will indicate Compressor A2 Low Water Temp Shutoff.
    - Compressor A2 will be locked out until the Leaving temperature is 6 degrees above setpoint.
2. If the Leaving Water Temperature for System A remains below setpoint for 1 minute or falls 3 degrees below setpoint, the following will occur:
    - Compressor A1 will deactivate.
    - Alarm LED will indicate Compressor A1 & A2 Low Water Temperature Shutoff.
    - Both Compressors will be locked out until the Leaving Temperature is 12 degrees above setpoint.

Temperature Sensor Testing

The following sensor voltage and resistance tables are provided to aid in checking sensors that appear to be operating incorrectly. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm that the sensor is operating correctly per the tables. Please follow the notes and instructions below each chart when checking sensors.

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors		
Temp (ºF)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	93333	4.620
-5	80531	4.550
0	69822	4.474
5	60552	4.390
10	52500	4.297
15	45902	4.200
20	40147	4.095
25	35165	3.982
30	30805	3.862
35	27140	3.737
40	23874	3.605
45	21094	3.470
50	18655	3.330
52	17799	3.275
54	16956	3.217
56	16164	3.160
58	15385	3.100
60	14681	3.042
62	14014	2.985
64	13382	2.927
66	12758	2.867
68	12191	2.810
69	11906	2.780
70	11652	2.752
71	11379	2.722
72	11136	2.695
73	10878	2.665

Table 5: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors		
Temp (ºF)	Resistance (Ohms)	Voltage @ Input (VDC)
74	10625	2.635
75	10398	2.607
76	10158	2.577
78	9711	2.520
80	9302	2.465
82	8893	2.407
84	8514	2.352
86	8153	2.297
88	7805	2.242
90	7472	2.187
95	6716	2.055
100	6047	1.927
105	5453	1.805
110	4923	1.687
115	4449	1.575
120	4030	1.469
125	3656	1.369
130	3317	1.274
135	3015	1.185
140	2743	1.101
145	2502	1.024
150	2288	0.952

Table 5, cont.: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Thermistor Sensor Testing Instructions

Use the resistance column to check the thermistor sensor while disconnected from the controllers (not powered).

Use the voltage column to check sensors while connected to powered controllers. Read voltage with meter set on DC volts. Place the "-" (minus) lead on GND terminal and the "+" (plus) lead on the sensor input terminal being investigated.

If the voltage is above 5.08 VDC, then the sensor or wiring is "open." If the voltage is less than 0.05 VDC, then the sensor or wiring is shorted.

OE275-01 Suction Pressure Transducer Testing for R-22 & R-410A Refrigerant

The Evaporator Coil Temperature is calculated by converting the Suction Pressure to Temperature. The Suction Pressure is obtained by using the OE275-01 Suction Pressure Transducer, which is connected into the Suction Line of the Compressor.

Use the voltage column to check the Suction Pressure Transducer while connected to the WSHP Module. Read voltage with a meter set on DC volts. If the temperature/voltage or pressure/voltage readings do not align closely with the chart, your Suction Pressure Transducer is probably defective and will need to be replaced.

See the OE275-01 Suction Pressure Transducer, Press pressures.ure, Temperature, and Voltage Charts for R-22 and R-410A Refrigerant testing (**Tables 6 & 7)**. The charts show a temperature range from 20°F to 80°F. For troubleshooting purposes, the DC Voltage readings are also listed with their corresponding temperatures and

OE275-01 Suction Pressure Transducer Coil Pressure – Temperature – Voltage Chart for R-22 Refrigerant					
Temperature °F	Pressure PSI	Signal DC Volts	Temperature °F	Pressure PSI	Signal DC Volts
20.00	31.13	1.0	55.32	93.39	2.0
20.00	37.36	1.1	58.86	99.62	2.1
20.46	43.58	1.2	62.13	105.84	2.2
25.71	49.80	1.3	65.27	112.07	2.3
30.84	56.03	1.4	68.42	118.29	2.4
35.41	62.26	1.5	71.39	124.52	2.5
39.98	68.49	1.6	75.20	130.75	2.6
44.00	74.71	1.7	77.00	136.97	2.7
48.00	80.94	1.8	79.80	143.20	2.8
51.78	87.16	1.9	80.00	149.42	2.9

Table 6: Coil Pressure/Voltage/Temp for OE275-01 Suction Pressure Transducers - R-22 Refrigerant

OE275-01 Suction Pressure Transducer Coil Pressure – Temperature – Voltage Chart for R-410A Refrigerant					
Temperature °F	Pressure PSI	Signal DC Volts	Temperature °F	Pressure PSI	Signal DC Volts
21.19	80.94	1.8	59.03	168.10	3.2
24.49	87.16	1.9	61.17	174.32	3.3
27.80	93.39	2.0	63.19	180.55	3.4
30.99	99.62	2.1	65.21	186.78	3.5
33.89	105.84	2.2	67.23	193.00	3.6
36.80	112.07	2.3	69.24	199.23	3.7
39.71	118.29	2.4	71.15	205.46	3.8
42.30	124.52	2.5	72.95	211.68	3.9
44.85	130.75	2.6	74.76	217.91	4.0
47.39	136.97	2.7	76.57	224.14	4.1
49.94	143.2	2.8	78.37	230.36	4.2
52.23	149.42	2.9	80.18	236.59	4.3
54.50	155.65	3.0			
56.76	161.88	3.1			

Table 7: Coil Pressure/Voltage/Temp for OE275-01 Suction Pressure Transducers - R-410A Refrigerant

Using LEDs to Verify Operation

The WSHP Module is equipped with LEDs that can be used to verify operation and perform troubleshooting. There are LEDs for communication, operation modes, diagnostic codes, and relays. The Module has twenty LEDs—one used for power, one used for communications, one used for operation status, one used for alarms, five used for compressor relays, four used for Suction Pressure Transducer status, and seven used for Binary Input status. See **Figures 5 and 6** for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter.

① Operation Status LEDs

"STATUS" - This is the status blink code LED. It will light up and first blink the address of the Module. It will then blink out the Mode of Operation. See **Table 8** below for Status Blink Code descriptions. The blink code descriptions are also located on the Module's front cover. See **Figure 5** for location.

No. of Blinks	Status
1	Off Mode
2	Cool Mode
3	Heat Mode

Table 8: STATUS LED Blink Codes

"COMM" - This LED will light up to indicate Communications with the VCM-X WSHP Controller or SA Controller. If Communications are established, the COMM LED will blink. You should not see this LED light up in stand-alone mode, because there would be no communications with the VCM-X WSHP Controller or SA Controller. See **Figure 5** for location.

"ALARM" - This is the diagnostic blink code LED. It will light up and blink out diagnostic codes. See **Table 9** below for Diagnostic Blink Code descriptions. The blink code descriptions are also located on the Module's front cover. See **Figure 5** for location.

No. of Blinks	Status
1	Low Suction Pressure
2	Compressor Lockout
3	Water Flow Failure
4	Low Leaving Water Temp

Table 9: ALARM LED Blink Codes

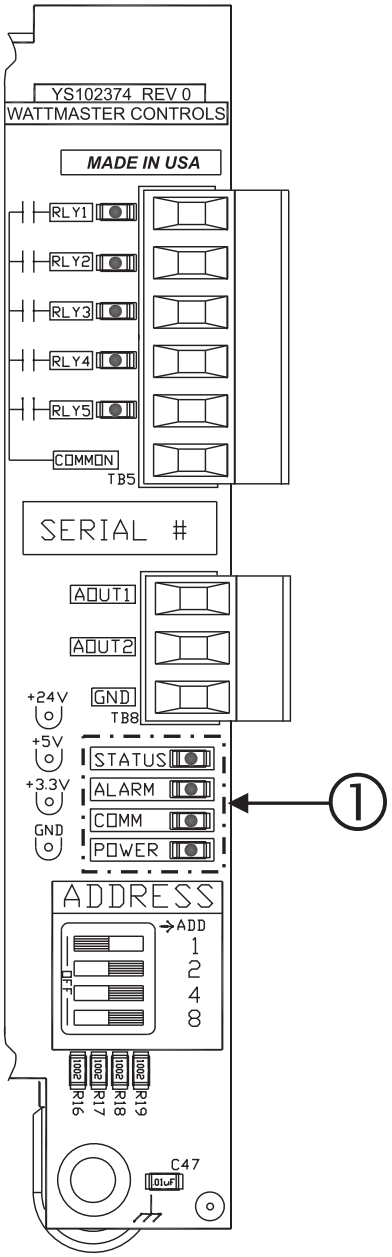


Figure 5: Operation Status LED Locations

② Suction Pressure Transducer LEDs

"PRES 1-4" - There are LEDs for each of the Suction Pressure Transducers. Since each compressor has a sensor, these LEDs which are located on the top left of the WSHP Module will give a better indication of which compressor is causing an alarm. See **Table 10** for PRES LED status descriptions. See **Figure 6** for locations.

No. of Blinks	Status
Solid On	Sensor is Detected and is OK
Solid Off	Sensor is Not Detected
1	Low Suction Pressure on this Compressor
2	Compressor is Locked Out

Table 10: PRES 1-4 LED Blink Codes

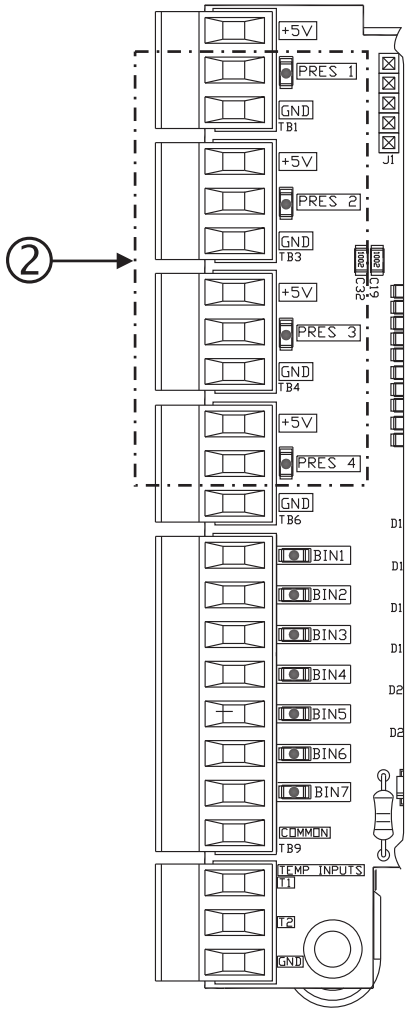


Figure 6: PRES 1-4 LED Locations

LED Diagnostics

"POWER" LED: When the WSHP Module is powered up, the POWER LED (located above the address switches) should light up and stay on continuously. If it does not light up, check to be sure that the power wiring is connected to the board, the connections are tight, and the VCM-X WSHP Controller or SA Controller is powered (if connected). If after making all these checks, the POWER LED does not light up, the module is probably defective.

"COMM" LED: When the WSHP Module is powered up while in Stand Alone Mode, the COMM LED does not light up. When the module is connected to the VCM-X WSHP Controller or SA Controller, the COMM LED should light up, indicating Communications. Each time Communications are detected, this LED should continuously blink on and off for a half second. This LED should never stop checking for a Communications signal. If it does not light up, check to be sure that the power wiring is connected to the board, the connections are tight, and the VCM-X WSHP Controller or SA Controller is powered. If after making all these checks, the COMM LED does not light up, the board is probably defective.

"STATUS" LED: As previously described, when the WSHP Module is first powered up, the STATUS LED will blink out the Mode of Operation.

"ALARM" LED: As previously described, this LED will blink on and off to indicate alarms and diagnostics.

NOTE: The WSHP Module contains no user-serviceable parts. Contact qualified technical personnel if your Module is not operating correctly.

Notes

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